DOES DAYLIGHT SAVINGS TIME AFFECT TRAFFIC ACCIDENTS?

A Senior Scholars Thesis

by

SOPHIA SHABNAM DEEN

Submitted to Honors and Undergraduate Research
Texas A&M University
in partial fulfillment of the requirements for the designation as

UNDERGRADUATE RESEARCH SCHOLAR

May 2012

Major: Economics

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Associate Director, Honors and Undergraduate Research: Duncan MacKenzie

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ABSTRACT

Does Daylight Savings Time Affect Traffic Accidents? (May 2012)

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This paper studies the effect of changes in accident pattern due to Daylight Savings Time (DST). The extension of the DST in 2007 provides a natural experiment to determine whether the number of traffic accidents is affected by shifts in hours of daylight using the year as control group. Using data on traffic accidents in Texas based on crash reports provided by the Texas Transportation Institute, and a difference in differences technique, this study creates a regression model to determine how significant this factor is in affecting traffic accident patterns as observed in the data. Results show that DST has no statistically significant effect on traffic accidents of all categories including (but not limited to) highway, non-highway, and accidents, accidents with injuries and no injuries, and accidents by drivers of all age-groups. This implies that the federal government's policy of DST (and its extension) has no costs incurred by a rise in motor vehicle crashes when it gets dark early.

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I am grateful to my advisor, Dr. Steve Puller, for his constant guidance, resourcefulness and patience. I am also grateful to Dr. Jonathan Meer, Dr. Dennis Jansen, and Mr. Jeremy West for their valuable input and assistance on this project. I am thankful to my family and friends for their support and encouragement. I gratefully acknowledge the support and assistance of the Undergraduate Research Program, especially Ms. Tammis Sherman, in writing and revising the thesis.

NOMENCLATURE

DST	Daylight Saving Time
TTI	Texas Transportation Institute
NHTSA	National Highway Traffic Safety Administration

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CHAPTER I

INTRODUCTION

Traffic accidents impact people's lives regardless of their age, occupation or location. Even if we consider simply the economic costs (apart from the psychological or physical impacts), we can identify huge costs associated with traffic crashes each year. It is therefore important to understand traffic accidents in terms of patterns, and in terms of contributing factors, and how policies, and programs regarding road, transportation, and even time, can affect the number and frequency of crashes as well as the pattern of crashes depending on the location or time of year.

Traffic accidents and economic costs

In a report for the National Highway Traffic Safety Administration (NHTSA) Blincoe et al. (2002) estimate the total economic cost of crashes occurring in 2000 to be $203.6 billion. This translates to a cost of $820 per capita and is equal to about 2.3 per cent of the US GDP. The costs included in this estimation include productivity losses, property damage, medical costs, rehabilitation costs, travel delay, legal and court costs, emergency services (such as medical, police, and fire services), insurance administration costs, and the costs to employers. In Texas only, the cost was estimated to be $19,761

This thesis follows the style of *The RAND Journal of Economics*.

million – amounting to $948 per capita (approximately 3.4% of per capita personal income). What these numbers mean is that accidents incur a substantial cost to the economy, and not only cumulatively, but also on individual levels. If not anything else, cost minimizing should be a reason to study traffic accidents and to in turn try to reduce the number of crashes.

Daylight savings as a determinant of crashes

Existing literature indicates that changes in daylight times affect traffic accidents. In the *New England Journal of Medicine*, Stanley Coren (1996) presents a study of accidents in Canada in 1991 and 1992 where he finds that shifts in sleep patterns caused an increased number of accidents in spring when drivers got one less hour of sleep and a decreased number of accidents in the fall when drivers gained an hour of sleep.

Due to the existence of observed seasonality in our data (discussed in detail on page 5) corresponding to the times at which DST begins and ends in a year, we investigate how this factor contributes to the occurrence of crashes. Although an hour's gain of sleep may cause fewer accidents, it is also possible that darkness (and hence reduced visibility) causes more accidents when DST ends in the fall and it gets dark earlier in the day. This is principally the factor this paper will investigate in depth: are there more accidents in late October because of DST ending?

In 2007, DST was extended to last four more weeks than in prior years as a direct result of the Energy Policy Act of 2005. The main purpose of the extension, as the name of the act suggests, was to conserve energy by reducing demand for electricity during extended daylight hours. In 2007 DST started three weeks early in March (instead of April) and a week later in November (instead of late October) which meant that in the last week of October in 2007, drivers drove in an extra hour of sunlight compared to the previous year, as shown in Figures 1 and 2 below.

Figure 1

Daylight Savings Time in 2006 – Harris County, Texas

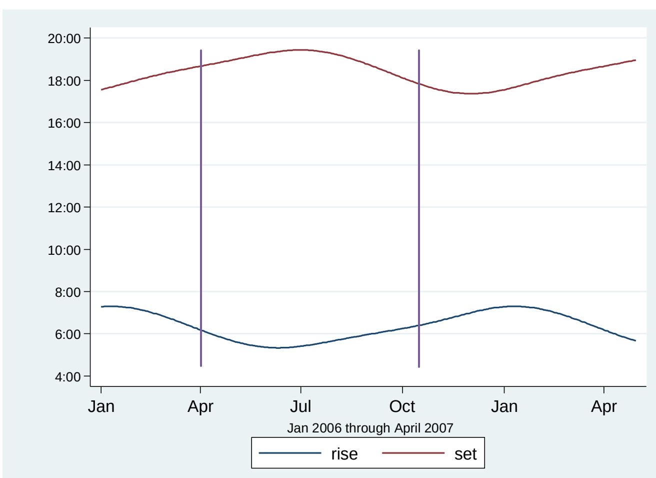
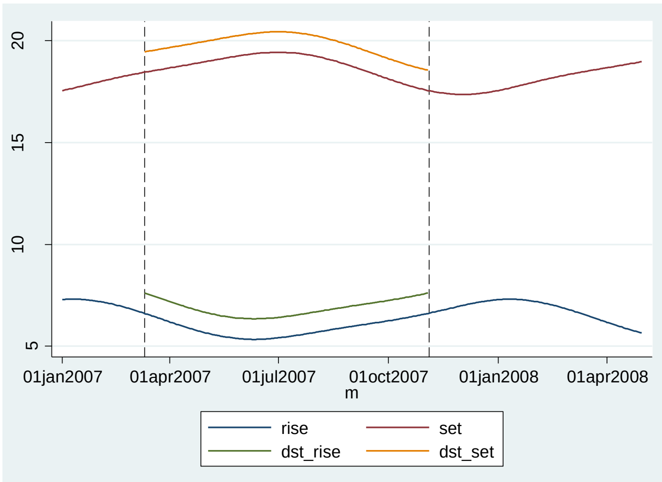


Figure 2

Extended Daylight Savings Time in 2007 – Harris County, Texas



An important motivation behind researching the role of changes in daylight savings on traffic accidents is to draw attention to the matter of how much of costs is the DST extension policy actually saving in a general equilibrium situation where there may be indirect savings/costs (such as economic cost reduction through fewer accidents) associated with the seen cost-reduction effects of energy conservation.

The fact that the same days that did not receive DST in 2006 continued to receive so in 2007 provides a natural experiment whereby those days in 2007 can be used as a control group in our difference in differences computation as discussed in the methodology chapter. Any effect of darkness on accidents should be picked up the number of accidents in the evening during the week, and any effect of changes in sleep pattern should be evident in the morning accidents during the same week.

Data

With access to detailed crash, person (non-identifying) and vehicle data from the Texas Transportation Institute (TTI), I was able to gather a sample of 3,134,384 observations of all the traffic accidents in Texas between 2003 and 2009 that were reported to a law enforcement agency.

Table 1 shows the statistical distribution of the variable *counts*, which essentially counts the number of accidents in each county by week of year for every year from 2003 to 2009; the mean number of accidents is 530 with a standard deviation of 572 (accidents).

TABLE 1: Summary statistics of the variable *counts*

Variable	Observations	Mean	Std. Dev.	Min	Max
counts	3,134,365	530.2191	572.6132	1	2255

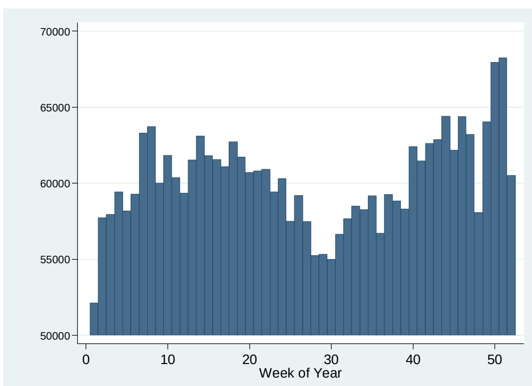
In transition to one year with one extra hour of daylight per week for one week, accident patterns may provide a clue as to whether sunlight or the lack thereof is a determinant of accidents. Investigating changes in daylight hours help explain the seasonality in the data described below.

Seasonality

When summarized and relevant variables plotted against week of year (time variable), the data shows seasonality; that is, when plotted against week of year there is an observable pattern in the variable that is plotted. The accident count in Texas as shown in Figure 3 is one illustration. Interestingly, the point where the number of crashes (*counts*) starts dropping around the point where the DST begins in March/April (depending on the year) and again the hike in crashes that begin around week 40, corresponds to the time DST time ends in late October/early November. This can be seen true for across individual counties in Texas, indicating that there is some relation between this transition and accidents.

Figure 3

Bar Graph of Total Accident Count – Texas



Correlations

It appears from the pattern displayed above that the number of crashes is not correlated with vehicle miles driven. The accident counts take a downward plunge beginning on week 20, and continue to fall until week 30 of the year. This period corresponds to the period of increased driving in the summer, so intuitively, we would expect the number of accidents to increase as well, if the two were correlated. The pattern varies very little from county to county – implying that number of accidents may have no correlation with the driving miles across the state of Texas.

CHAPTER II

METHODS

This study uses data provided by the Texas Transportation Institute (TTI), containing data on annual motor vehicle crashes in Texas from 2003 through 2009. The data were used to examine the annual patterns in traffic accidents over the weeks of the year where week-of-year is initially defined by seven days starting January 1 of each year and so forth. In addition, data for daily sunrise and sunset times were gathered from the Astronomical Applications Department of the U.S. Naval Observatory to calculate daylight hours received by each of the five biggest counties in Texas: Harris, Dallas, Bexar, Tarrant, and Travis. The amount of precipitation in each of these counties was acquired from the Satellite and Information Service of the National Oceanic and Atmospheric Administration (NOAA).

The study also used the statistical software Stata to organize data, analyze data through the use of graphs, tables and summary statistics, and examine relationships between variables. Once organized into a complete dataset containing all the traffic accidents, and weather and daylight information, Stata was used to count the number of accidents over the weeks of year cumulatively in the state of Texas as well as separately in different counties, and across several different categories such as crash severity, road type, etc. narrowing down the focus of the research to 895,579 observations.

Difference-in-differences

The difference-in-differences method is used to observe outcomes for two groups for two different time period. Wooldridge and Imbens (2007) describe that the method is used when one group is exposed to a treatment in the first period but not in the second period. The second group is not exposed to the treatment in either period. In the natural experiment setting of the DST extension, a difference in differences can be extracted when looking at the days around the last Sunday of October in the years 2006 and 2007. Because of the existence of a significant day-of-week effect on accidents (see Appendix Table A1), the grouping of days around the last Sunday of October needs to be done so as to remove the day-of-week bias. Hence, we group the seven days prior to the last Sunday in October as our DST group (these days experienced DST in 2006). The seven days following (and including) the last Sunday in October are included in group named No-DST (2006) since DST ended on Sunday, Oct 28. On the other hand, due to the extension, both these weeks in 2007 were untreated (i.e. subject to DST which did not end until November 4) thereby making the same days in 2007 the control group. Figure 4 shows the four groups used in the difference-in-differences method.

Figure 4

Visual Representation of the Diff-in-diffs approach

2006	DST	No DST
	Oct 22 - 28	Oct 29 – Nov 4
2007	DST	DST
	Oct 21 - 27	Oct 28 – Nov 3

Regression

The difference-in-differences regression approach takes the numerical analysis of the method described above and applies to a regression analysis to control for other factors that may be causing the change we observe so as to avoid attributing the change to a wrong variable. In this model, I defined the dependent variable by defining different categories of accidents, as listed in Table 2.

TABLE 2: Dependent Variable Categories

Category	Description
AM	Accidents that occurred between 4 am and 10:59 am.
PM	Accidents that occurred between 5 pm and 8:59 pm.
I	Accidents with injury
NI	Accidents with no injury
F	Fatal accidents
HWY	Highway accidents (includes interstates and US and state highways)
NHWY	Non-highway accidents (includes farm-to-market, city street, non-trafficway, and all other types of road)
NY	Accidents involving at least one non-young person; non-young defined as person of ages 25 through 64
Y	Accidents involving at least one non-young person; non-young defined as person of ages 16 through 24

For further analysis, I also combined categories and included them as the dependent variables in the regressions, for example fatal highway accidents. A description is provided in the Appendix (Table A2).

The independent variables in this regression are dummies for each year (2006 and 2007), a dummy for the last week of October, an interaction term between the week dummy and the dummy for year 2006, a county dummy, and a precipitation dummy (1 if there is presence of any precipitation). The model therefore is as follows:

$$Y_{it} = \alpha + \delta_i \sum_2^{254} county_{it} + \beta precipitation_{it} + \theta_1 dummy\_2006 + \theta_2 dummy\_2007$$

$$+ \theta_3 oct\_lastweek + \theta_4\, 2006oct\_lastweek + \varepsilon_{it}$$

The coefficient of the interaction term (θ_4) gives the effect of getting dark earlier in the evening (which occurred in the last week of October, 2006 before DST was pushed back another week in 2007). The dummy for Anderson County is excluded from the model because of collinearity. The county dummies are included to allow for different counties to have different average numbers of accidents and thereby controlling for differences in geographical location.

CHAPTER III

RESULTS

This section discusses the results of the difference-in-differences method and the regression model specified above.

Difference-in-differences

The mean number of accidents among all counties was calculated for each group such that the groups in 2007 were the control groups. Table 3 shows the results from the basic difference-in-differences analysis.

TABLE 3: Difference-in-differences

All Accidents	DST (2006)	NonDST (2006)	
	35.77	34.5	-1.27
	DST (2007)	DST (2007)	
	37.4	36.5	-0.9
		Diff-in-diff	**0.37**
Accidents between 4 AM and 10:59 AM	AM_DST (2006)	AM_NonDST (2006)	
	6.31	5.44	-0.87
	AM_DST (2007)	AM_DST (2007)	
	6.98	6.07	-0.91
		Diff-in-diff	**-0.04**
Accidents between 5 PM and 8:59 PM	PM_DST (2006)	PM_NonDST (2006)	
	7.9	8.57	0.67
	PM_DST (2007)	PM_DST (2007)	
	8.38	8.42	0.04
		Diff-in-diff	**-0.63**

In each subtype, this gives us two sets of differences: the difference between Group 1 and 2 and the difference between Group 3 and 4.

Difference-in-differences = [Group 2 – Group 1] – [Group 4 – Group 3]

For example, in the case of all accidents, diff-in-diff = [34.5 – 35.77] – [36.5 – 37.4] = -1.27 – (-0.9) = 0.37. Similar calculations are done for morning and evening accidents.

The results imply that in Texas, on average across counties, the difference in the number of accidents due to DST ending were very low. Although the differences are negative for morning and evening accident, the positive difference for overall accidents may be explained by an increase in the number of accidents at other times of the day.

Regression results

The first set of regressions that were carried out included dummies for all counties in Texas (for county fixed effect) but no precipitation data. When each category of accidents is regressed on the independent variables in the model, and the coefficients of the interaction term is found, it can be seen that the benefit of pushing back DST by one week in terms of accidents is negative for some categories and positive for others. In other words, the coefficient of the interaction term being negative indicates that there are fewer morning accidents, accidents with injuries, fewer fatal accidents and accidents by non-young drivers. At the same time, there are more accidents in the evening, non-injured accidents, highway accidents and accidents by young drivers. However, none of these coefficients are statistically significant at the 5% significance level (Table A3).

Moreover, these regressions do not control for precipitation. In order to do so, we include the precipitation dummy in our regression, and instead of all 254 counties in Texas, include the five major counties in Texas, namely, Harris, Bexar, Tarrant, Travis and Dallas. Although this somewhat compromises the number of observations, we still have over 3,500 observations to make the regressions robust.

TABLE 4: Difference-in-differences regression

	AM	**PM**	**I**	**NI**	**F**	**HWY**	**NHWY**	**NY**	**Y**
	b/(se)	b/(se)	b/(se)	b/(se)	b/(se)	b/(se)	b/(se)	b/(se)	b/(se)
dummy06	-0.8102	-0.3781	2.5741*	-6.3508*	-0.0114	-2.4999*	-1.3777	-2.2763	-0.4968
	(0.9091)	(0.6817)	(0.8913)	(1.2658)	(0.0547)	(0.9611)	(1.2164)	(1.2079)	(0.4741)
octnov	1.1809	4.1669	0.3232	7.1953	-0.3226	3.1977	5.0683	4.6342	-0.0447
	(3.0330)	(3.3671)	(3.5711)	(4.9660)	(0.1882)	(3.9419)	(4.2445)	(4.9096)	(1.5758)
2006_oct	**1.5034**	**1.5139**	**3.0499**	**-3.4249**	**0.3628**	**2.5046**	**-3.0884**	**-1.1971**	**2.8076**
	(4.6563)	(5.5743)	(5.8205)	(7.4752)	(0.3629)	(6.5981)	(6.7588)	(7.6664)	(2.6375)
Dallas	-15.9195*	-20.0134*	2.9684+	-77.2384*	0.4412*	-37.0374*	-41.0129*	-41.6414*	-19.6873*
	(1.4292)	(1.1082)	(1.3125)	(2.0875)	(0.0795)	(1.7163)	(1.7655)	(1.9346)	(0.7666)
Harris	43.1603*	35.6292*	90.1795*	67.9180*	1.0845*	30.3686*	131.1315*	93.3728*	28.5502*
	(1.9196)	(1.4298)	(1.7497)	(2.7374)	(0.0957)	(1.9121)	(2.6007)	(2.5758)	(0.9559)
Tarrant	-27.5187*	-26.9815*	-21.5036*	-88.3174*	0.0882	-49.5462*	-67.2652*	-66.3631*	-22.9844*
	(1.3851)	(1.1007)	(1.2702)	(2.1040)	(0.0718)	(1.6869)	(1.7467)	(1.9206)	(0.7726)
Travis	-42.7524*	-46.7678*	-44.8954*	-134.1787*	-0.1493+	-85.2862*	-104.6246*	-101.9432*	-40.0649*
	(1.2818)	(0.9940)	(1.1439)	(1.9323)	(0.0663)	(1.4994)	(1.5999)	(1.7741)	(0.6873)
precip	4.2456*	-0.2506	3.0526*	8.0495*	-0.1001	6.2788*	5.4387*	6.1902*	3.7074*
	(1.1103)	(0.7786)	(1.0235)	(1.4606)	(0.0604)	(1.1108)	(1.4084)	(1.3966)	(0.5506)
Cons	61.7610*	67.0099*	91.9541*	170.5380*	0.7183*	120.3803 *	156.1306*	148.7039*	59.3760*
	(1.3104)	(1.0434)	(1.1455)	(2.0592)	(0.0587)	(1.5266)	(1.7080)	(1.8677)	(0.7029)
DepVar	Morning	Evening	Injured	Not injured	Fatal	Highway	Non-highway	Non-young	Young
N	3650	3650	3650	3650	3650	3650	3650	3650	3650
R^2 adj	0.5495	0.6546	0.7523	0.7873	0.0682	0.6623	0.8380	0.7801	0.7391

+ p<0.05 * p<0.01. Bexar is the excluded county variable, and the dummy for 2007 is the excluded year variable.

As Table 4 shows, controlling for precipitation does not change the statistical significance of the interaction term; this means that although DST seems to have a positive effect on morning, evening, injured, fatal, highway, and young driver accidents and negative effect on non-injured and non-highway accidents, on a 5% level of significance we fail to reject the hypothesis that DST has no effect on traffic accidents. The coefficients on the county dummies account for county fixed effect where Bexar County is the dummy being compared to.

Further analysis shows that all the combinations of categories, e.g. fatal highway accidents or non-highway young driver accidents etc. also show the same results as the ones discussed above.

CHAPTER IV

SUMMARY AND CONCLUSION

Summary

Previous studies suggest that changing the clock back and forth from Daylight Savings Time to standard time affect traffic accidents: sometimes by reducing the number of accidents when people sleep an extra hour in the morning or sometimes by increasing the number of accidents in the morning because of a sleeping-hour lost. However, in this study, the focus has been to identify any effects of DST due to getting dark early when DST ends in the fall. Using a large sample of accident and weather data in Texas, a natural experiment was set up so as to apply a difference-in-differences technique. The Energy Policy Act of 2005 that dictated an extension of DST in 2007 provided an opportunity for the natural experiment whereby one group of days that had experienced darkness early could be considered as the treated group, while another group that received DST was the control group. The same groups of days in the next period were also used in the analysis to control for other factors that may have caused the difference in accidents between the DST (control) and non-DST (treated) groups.

Results show that the effect of DST on the number of accidents is statistically insignificant; at the 5% significance level we fail to reject the hypothesis that Daylight Savings has zero effect on the number of accidents. And because I used a very big sample in a large state such as Texas, it may be true to the real relationship.

Conclusion

There is much discourse about the observance of Daylight Savings Time. Since its inception to its extension in the recent past, not everyone has been unanimous in accepting it. Hawaii and Arizona for instance do not observe DST, and neither did Indiana prior to 2005. Linked to the extension of DST in 2007 is the question of energy saving; the government's goal in extending DST was to reduce electricity consumption by better aligning time to the hours of daylight during the day.

In researching the effect of DST on traffic accidents, I tapped into the possibility that there may be other costs that off-set the savings from saving energy. However, since it is clear that Daylight Savings Time barely increases the number of accidents in Texas, it can be concluded that at least in terms of costs incurred by motor vehicle crashes, DST imposes no costs to the government or private individuals. And this finding is important because Texas is a large state and this study essentially includes all accidents in the state, thereby adding to the understanding and analyses of traffic accidents in Texas.

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APPENDIX

Table A1: Regression of accident categories on day of week, hours of daylight, county

	I (std. err.)	NI (std. err.)	F (std. err.)	HWY (std. err.)	NHWY (std. err.)	NHWY_NI (std. err.)	NHWY_I (std. err.)	NHWY_F (std. err.)
Cons	25.4953*	35.3804*	0.7991*	29.3122*	40.8279*	20.2589*	13.2847*	0.4397*
	(0.9854)	(1.1372)	(0.0600)	(1.0255)	(1.1615)	(0.7076)	(0.6328)	(0.0434)
harris	0.2410*	0.3698*	0.0019*	0.1894*	0.4462*	0.2567*	0.1707*	0.0013*
	(0.0020)	(0.0021)	(0.0001)	(0.0020)	(0.0022)	(0.0014)	(0.0013)	(0.0001)
bexar	0.0618*	0.3371*	-0.0008*	0.2065*	0.2103*	0.1686*	0.0286*	-0.0004*
	(0.0035)	(0.0046)	(0.0001)	(0.0050)	(0.0043)	(0.0026)	(0.0021)	(0.0001)
travis	-0.3699*	-0.4809*	-0.0059*	-0.3677*	-0.5627*	-0.2867*	-0.2079*	-0.0027*
	(0.0098)	(0.0125)	(0.0004)	(0.0108)	(0.0132)	(0.0074)	(0.0059)	(0.0003)
tarrant	-0.0307*	0.0538*	-0.0017*	0.0455*	-0.0294*	0.0085+	-0.0295*	-0.0010*
	(0.0054)	(0.0067)	(0.0002)	(0.0065)	(0.0066)	(0.0038)	(0.0031)	(0.0002)
D~light	0.4720*	-0.6855*	-0.0083	-0.3181*	0.0260	-0.2919*	0.3699*	-0.0076+
	(0.0768)	(0.0886)	(0.0046)	(0.0779)	(0.0919)	(0.0563)	(0.0502)	(0.0033)
Precip	2.6795*	5.8746*	-0.0400*	4.7258*	4.2193*	2.8787*	1.1762*	-0.0298*
	(0.2704)	(0.3160)	(0.0142)	(0.2853)	(0.3208)	(0.1947)	(0.1746)	(0.0103)
mon	4.8909*	8.4090*	-0.2594*	3.5286*	5.9471*	5.4538*	3.4795*	-0.1172*
	(0.3793)	(0.4310)	(0.0254)	(0.4136)	(0.4226)	(0.2646)	(0.2406)	(0.0183)
tues	6.1179*	9.6058*	-0.3175*	4.2291*	6.8746*	6.0492*	4.4264*	-0.1530*
	(0.3767)	(0.4245)	(0.0244)	(0.4167)	(0.4239)	(0.2629)	(0.2432)	(0.0173)
wed	6.0941*	9.7776*	-0.2792*	4.3819*	7.0128*	6.2644*	4.2535*	-0.1365*
	(0.3846)	(0.4307)	(0.0251)	(0.4143)	(0.4273)	(0.2668)	(0.2448)	(0.0176)
thurs	6.2496*	10.4718*	-0.2559*	5.1346*	7.4194*	6.3127*	4.3581*	-0.1159*
	(0.3869)	(0.4377)	(0.0250)	(0.4170)	(0.4383)	(0.2715)	(0.2488)	(0.0181)
fri	13.2327*	18.9397*	-0.1009*	11.9271*	17.2839*	11.4909*	8.1479*	-0.0684*
	(0.4379)	(0.4880)	(0.0275)	(0.4613)	(0.4947)	(0.3013)	(0.2788)	(0.0192)
sat	7.7216*	9.9647*	0.0462	6.5418*	10.9988*	6.3591*	4.6813*	0.0228
	(0.4116)	(0.4688)	(0.0289)	(0.4623)	(0.4569)	(0.2795)	(0.2539)	(0.0205)
N	12785	12785	12785	12785	12785	12785	12785	12785
R^2 adj	0.8013	0.8905	0.1193	0.7624	0.9073	0.8951	0.8156	0.0871

+ p<0.05 * p<0.01. Categories for accidents in order that they appear on this table are: Injured, Not Injured, Fatal, Highway, Non-Highway, Non-highway with no injury, non-highway with injury, Non-highway Fatal. Sunday is the excluded day variable, Dallas is the excluded county variable.

Table A1: Continued

	NY_HWY (std. err.)	Y_HWY (std. err.)	NY_NI (std. err.)	Y_NI (std. err.)	NY_I (std. err.)	Y_I (std. err.)	NY_F (std. err.)
Cons	33.8372*	14.8686*	36.3375*	17.9931*	31.4881*	13.1523*	0.8313*
	(2.7631)	(1.0029)	(3.7504)	(1.4837)	(2.7586)	(1.0344)	(0.0864)
harris	0.2187*	0.0724*	0.4218*	0.1602*	0.2784*	0.0989*	0.0018*
	(0.0054)	(0.0018)	(0.0079)	(0.0030)	(0.0058)	(0.0021)	(0.0002)
bexar	0.1921*	0.0869*	0.3359*	0.1469*	0.0395*	0.0304*	-0.0009*
	(0.0093)	(0.0034)	(0.0118)	(0.0046)	(0.0077)	(0.0029)	(0.0002)
travis	-0.4890*	-0.1470*	-0.5680*	-0.1955*	-0.5290*	-0.1628*	-0.0053*
	(0.0197)	(0.0073)	(0.0229)	(0.0094)	(0.0209)	(0.0077)	(0.0007)
tarrant	-0.0140	0.0148*	-0.0161	0.0364*	-0.1045*	-0.0047	-0.0021*
	(0.0119)	(0.0046)	(0.0130)	(0.0056)	(0.0112)	(0.0045)	(0.0003)
D~light	-0.6295*	-0.1738+	-0.9083*	-0.2973+	0.2230	0.2095*	-0.0174*
	(0.2196)	(0.0785)	(0.3008)	(0.1180)	(0.2182)	(0.0808)	(0.0066)
Precip	-0.7811	0.2411	-0.4299	0.2357	-1.7434+	-0.2313	-0.0797*
	(0.7380)	(0.2675)	(1.0338)	(0.4065)	(0.7413)	(0.2779)	(0.0204)
mon	13.8884*	-0.4169	19.3141*	1.3036+	13.7494*	0.3562	-0.1611*
	(0.9916)	(0.3821)	(1.3499)	(0.5490)	(1.0190)	(0.4029)	(0.0354)
tues	16.8165*	0.0376	22.4615*	2.1963*	16.9978*	0.9377+	-0.2242*
	(1.0410)	(0.3936)	(1.3994)	(0.5665)	(1.0425)	(0.4069)	(0.0343)
wed	16.4209*	0.0665	22.2795*	2.3128*	16.4838*	0.9512+	-0.1993*
	(1.0023)	(0.3808)	(1.3878)	(0.5589)	(1.0235)	(0.4057)	(0.0353)
thurs	16.6370*	0.3466	22.6216*	2.5200*	16.1571*	1.0919*	-0.1548*
	(1.0262)	(0.3864)	(1.4119)	(0.5656)	(1.0356)	(0.4104)	(0.0362)
fri	24.5555*	4.2740*	31.1843*	7.5076*	24.8180*	4.6630*	-0.0030
	(1.1480)	(0.4375)	(1.5673)	(0.6494)	(1.1621)	(0.4515)	(0.0395)
sat	10.8302*	2.7992*	13.8415*	4.1511*	12.2925*	2.8968*	0.0579
	(0.9647)	(0.4219)	(1.3011)	(0.5803)	(0.9955)	(0.4328)	(0.0390)
N	12785	12785	12785	12785	12785	12785	12785
R^2 adj	0.3442	0.3100	0.4451	0.4191	0.4161	0.3645	0.0516

+ $p<0.05$ * $p<0.01$. Sunday is the excluded day variable, Dallas is the excluded county variable.
Categories for accidents in order that they appear on this table are Non-young (driver's age between 25 and 64) Highway, Young Highway (driver's age between 16 and 24), Non-young Not Injured, Non-young Injured, Young injured, Non-young Fatal. Sunday is the excluded day variable, Dallas is the excluded county variable.

Table A1: Continued

	YF (std. err)	HWY_NI (std. err)	HWY_F (std. err)	HWY_I (std. err)
Cons	0.2691*	15.1215*	0.3594*	12.2106*
	(0.0472)	(0.6364)	(0.0412)	(0.5261)
harris	0.0007*	0.1131*	0.0005*	0.0704*
	(0.0001)	(0.0013)	(0.0001)	(0.0010)
bexar	-0.0003*	0.1685*	-0.0004*	0.0331*
	(0.0001)	(0.0033)	(0.0001)	(0.0018)
travis	-0.0026*	-0.1942*	-0.0032*	-0.1620*
	(0.0003)	(0.0064)	(0.0003)	(0.0049)
tarrant				
	-0.0007*	0.0452*	-0.0007*	-0.0012
	(0.0002)	(0.0038)	(0.0002)	(0.0030)
D~light	0.0035	-0.3936*	-0.0007	0.1022+
	(0.0037)	(0.0490)	(0.0031)	(0.0402)
Precip	-0.0315*	2.9960*	-0.0102	1.5033*
	(0.0106)	(0.1789)	(0.0098)	(0.1404)
mon	-0.1635*	2.9552*	-0.1422*	1.4114*
	(0.0206)	(0.2529)	(0.0171)	(0.2103)
tues	-0.1535*	3.5566*	-0.1645*	1.6915*
	(0.0207)	(0.2588)	(0.0166)	(0.2101)
wed	-0.1609*	3.5132*	-0.1427*	1.8407*
	(0.0205)	(0.2534)	(0.0170)	(0.2129)
thurs	-0.1504*	4.1591*	-0.1400*	1.8915*
	(0.0206)	(0.2570)	(0.0169)	(0.2116)
fri	-0.0575+	7.4488*	-0.0325	5.0848*
	(0.0227)	(0.2815)	(0.0189)	(0.2354)
sat	0.0215	3.6055*	0.0234	3.0403*
	(0.0239)	(0.2807)	(0.0197)	(0.2305)
N	12785	12785	12785	12785
R^2 adj	0.0394	0.7671	0.0467	0.5971

+ p<0.05 * p<0.01. Sunday is the excluded day variable, Dallas is the excluded county variable.
Categories for accidents in order that they appear on this table are Young Fatal, Highway with no injury, Highway Fatal, Highway with Injury. Sunday is the excluded day variable, Dallas is the excluded county variable.

Table A2: Combination of categories

Category	Accidents with…
NY_NI	Non-young driver(s), no injuries
NY_I	Non-young driver(s), injuries
NY_F	Non-young driver(s), fatal
Y_NI	Young driver(s), no injuries
Y_I	Young driver(s), injuries
YF	Young driver(s), fatal
NY_HWY	Non-young driver on the highway
Y_HWY	Young driver on the highway
HWY_NI	Highway accident with no injuries
HWY_I	Highway accident with injuries
HWY_F	Highway accident with fatality
NHWY_NI	Non-Highway accident with no injuries
NHWY_I	Non-Highway accident with injuries
NHWY_F	Non-Highway accident with fatality

Table A3: Regression of major categories with all county dummies included

	AM	PM	I	NI	F	HWY	Y	NY
	b/(se)	b/(se)	b/(se)	b/(se)	b/(se)	b/(se)	b/(se)	b/(se)
dummy2006	-0.1618*	-0.1632*	0.0494	-0.7197*	0.0009	-0.3550*	-0.1448*	-0.3626*
	(0.0370)	(0.0290)	(0.0375)	(0.0534)	(0.0034)	(0.0426)	(0.0215)	(0.0490)
octnov	0.3511*	0.2935+	0.4004+	0.5829+	-0.0082	0.2629	0.1070	0.5424*
	(0.1334)	(0.1443)	(0.1614)	(0.2272)	(0.0139)	(0.1776)	(0.0834)	(0.2096)
dummy2006_ octnov	**-0.0700**	**0.2165**	**-0.2325**	**0.0130**	**-0.0131**	**0.2669**	**0.1033**	**-0.1629**
	(0.1942)	(0.2248)	(0.2445)	(0.3238)	(0.0216)	(0.2747)	(0.1258)	(0.3073)
Cons	1.4419*	1.2730*	1.9633*	3.5664*	0.0956*	3.7087*	1.3659*	3.0014*
	(0.0720)	(0.0660)	(0.0801)	(0.1126)	(0.0192)	(0.1208)	(0.0486)	(0.0859)
DepVar	AM	PM	injured	not_injured	fatal	highway	young	nonyoung
N	1.01e+05	1.01e+05	1.01e+05	1.01e+05	1.01e+05	1.01e+05	1.01e+05	1.01e+05
R^2 adj	0.7976	0.8651	0.9235	0.9109	0.1135	0.8869	0.9036	0.9235

The dummy for the year 2007 excluded because of collinearity. Unreported coefficients include those of all the county dummies which allow for different counties to have different average number of accidents.

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